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The Role of the Tracked Amphibian in Modern Amphibious Warfare

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The development of the tracked amphibian in the years immediately preceding World War II made the island-hopping campaigns of the Pacific War feasible. However, the development of guided missiles, tactical nuclear weapons, and mechanized divisions has made the traditional tactics of amphibious operations increasingly vulnerable. With the introduction of helicopter assault forces and more advanced amphibians, new tactics are needed to counter the possible effects of modern weaponry.

THE ROLE OF THE TRACKED AMPHIBIAN IN MODERN AMPHIBIOUS WARFARE

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INTRODUCTION

Born in the Florida swamps, the illegitimate offspring of a small boat and a tank, orphaned as a logistical beast of burden during the early campaigns of the Pacific War, given its birthright across the reefs at Tarawa, the tracked amphibian became, in the truest sense, the link that projects seapower on shore. Today, the vehicle remains an important part of the U.S. Marine Corps inventory for amphibious operations.

It can be said, with little fear of contradiction, that for the past 20 or more years the doctrine for employment of the vehicle for the most part has remained unchanged. Boat lanes are established, waves are formed, and guide boats frantically attempt to herd their sluggish and unwieldy amphibians toward the beach. The carefully designed assault upon a defended shoreline, with the establishment of a beachhead, is a time-consuming process. It is the first of two moves; the second, after sufficient combat power has been built up in the beachhead, is the breakout into the enemy's hinterland.

The tracked amphibian has been used in this type of operation in order to overcome natural underwater obstacles such as coral reefs and to place troops directly on a defended beach ready to fight.

The amphibious battlefields of the future may not be ringed with coral reefs and defended in depth by troops and fortifications. They may, instead, be ringed with cruise missiles and defended in depth by the mobility of armored units. What then will be the role of the amphibian, and how will it be employed?

To answer these questions this paper will briefly examine the rationale behind the development of the vehicle, provide the background that established the doctrine for its present employment, and propose some other approaches to the vehicle's utilization in the future.

There will be no attempt in this paper to compare the relative effectiveness of the amphibian to other means of troop and cargo delivery, because, like many other items in a military weapons system, it is but a part of the overall scheme, and by itself it cannot accomplish a mission.

By 1972 the Marine Corps will acquire a new type of amphibian of advanced design. This vehicle already has proven itself in tests, so much so that it promises to be the first truly amphibious armored personnel carrier. It will possess mobile capabilities far beyond the present doctrinal state of the art.

It is now time to examine the changing world of the tracked amphibian in order that this unique machine can be given an updated breath of doctrinal life. It will be the purpose of this paper to suggest some new doctrine to complement the new vehicle.

I—THE DEVELOPMENT OF AN AMPHIBIAN

> The development of the amphibian tractor or LVT (Landing Vehicle Tracked), which began in the middle 1930's, . . . was one of the most important modern technical contributions to ship to shore operations. Without these landing vehicles, our amphibious offensive in the Pacific would have been impossible.[1]

Early Beginnings. Even before the First World War and the British failure at Gallipoli, amphibious warfare was a dead issue. It appeared that modern military technology had overtaken the art of placing soldiers on land from the sea. The disaster at the Dardanelles merely confirmed this thesis.[2]

When World War I ended, the U.S. Marine Corps, having had a taste of its first sustained ground combat, was swiftly reduced in size to conform to its former mission of being the Navy's soldiers of the sea. Despite this reduction of forces, there were those still in the Marine Corps who were not satisfied with the traditional role of guards and policemen. In particular, the Maj. Gen. Commandant, John A. Lejeune and one of his young staff officers, Lt. Col. Earl H. Ellis, saw in amphibious warfare an opportunity to expand on the Corps mission. Under Lejeune's leadership the mission of the Marine Corps was oriented toward the seizure of advanced naval bases. Ellis' fertile mind provided the scenario and the plan to support it.

Ellis' scenario was set in the Japanese mandated islands of the Central Pacific, where his plan called for a series of limited amphibious operations designed to seize these islands successively. This plan was titled *Operation Plan 712 H, Advance Base Operations in Micronesia.* OpPlan 712 H was approved by Commandant Lejeune on 23 July 1921 and stands today as an accurate forecast of the step-by-step island campaign in the Pacific 21 years later.[3]

Though Ellis lost his life in 1923, while "visiting" the Japanese mandates on an official leave of absence, the Marine Corps and the Navy continued throughout the pre-World War II years to examine, plan, and practice the complex and demanding business of seizing advance naval bases by assault from the sea.[4]

During these years between conflicts, the primary doctrinal thrust of the plans and practices was toward fighting a future war against Japan in the Pacific. As it developed, the doctrine oriented itself in the direction of a frontal assault against a heavily defended island beach which was surrounded by a coral reef.

In order to develop the necessary beach assault technique under the conditions anticipated, both the Navy and the Marine Corps conducted a series of Fleet Landing Exercises in the Caribbean and off the coast of California. These exercises eventually established

an initial doctrine in the form of the Corps *Tentative Manual for Landing Operations* and the Navy's *Fleet Training Publication 167.*[5]

Without acceptable landing craft to implement it, however, this doctrine was unrealistic. Commanders noted a whole range of ills associated with landing in standard Navy boats. These ills were essentially grouped into three broad categories: (1) the lack of speed and maneuverability: (2) the lack of stable handling characteristics in the surf; and (3) the lack of a rapid means to debark troops at the water's edge.[6]

As a result of these early amphibious exercises, the Navy began to work in earnest to solve the landing craft problem. The Marine Corps, in the meantime, attempted to experiment with a tracked amphibian.

In 1924 an amphibian tank appeared on the scene. Its designer, J. Walter Christie, claimed that his machine could operate in the water at speeds of up to 7 knots. On land the vehicle could travel across country at up to 15 miles an hour. The vehicle did perform well on land, but in the water it was quite another story. Only on a calm day in the Potomac River did it prove to be seaworthy. In any rougher water the amphibian was subject to swamping.[7] With lack of money as a major cause as well as the absence of acceptable waterborne performance by the Christie vehicle, the amphibian tank program was abandoned by the Marine Corps. Nearly 15 years would pass before interest, know-how, and funds would again become available for another such undertaking.

Donald Roebling's Alligator. At the conclusion of the fleet exercises of February 1937, the frustrated participants recommended that an amphibian tank be developed "and fast."[8] It undoubtedly would have surprised the authors of this recommendation to know that a tracked amphibian did exist and was actually operating within the United States. At this time, tests were being conducted in the Florida swamps, and the scene was an enterprising reporter from the newly established *Life* magazine who was making notes and taking pictnres. A few months later, in October of 1937, an inconspicuous two-page article appeared in *Life.* It was titled "Roebling's Alligator for Florida Swamp Rescues." The text explains:

> Shocked hy the great Florida hurricane of Septemher 1935, John A. Roebling of New Jersey's bridge building family told his 28 year old son, Donald, that some sort of amphihian vehicle might have saved many lives hy transporting victims through the swamps, over drowned roads, aeross dehris filled bayous. Donald agreed, went to work, after many expensive months produeed the "Alligator" shown in operation on his Florida estate.[9]

The photographs accompanying the article show a silvery tracked vehicle resembling to some extent a World War I tank with an open top. The captions under these pictures inform the reader of the truly remarkable features of the vehicle. It was constructed of duralumin and weighed only 8,700 pounds. Powered by an 87 horsepower, Ford V-8 engine, it had a speed of 18 miles per hour on land and 8.5 miles per hour in the water. Propulsion in either environment was by lugs attached to an endless track. The cost was only $10,000.[10]

Apparently marines didn't subscribe to *Life* in 1937, but Rear Adm. Edward C. Kalbfus did. In his capacity as the Commander, Battleships, Battle Force, U.S. Fleet, he mentioned the article to the Commanding General of the Fleet Marine Force during a joint conference on a fleet exercise. The Commander of the Fleet Marine Force, Maj. Gen. Lewis

McC. Little, expressed more than a mild interest in the Roebling invention. He dispatched a clipping of the article to the Commandant of the Marine Corps.[11]

The Landing Vehicle Tracked (LVT) Is Born. To the Commandant and particularly to Brig. Gen. Frederick L. Brodman, the President of the Marine Corps Equipment Board, the prospect of acquiring a machine which might solve the landing craft problem was euphoric. With an amphibian vehicle capable of traversing coral reefs, rocky beaches, and swampy lowlands, the selection of landing sites would be infinitely more varied. No longer could an enemy concentrate his defenses only around those areas accessible to small boats and landing craft. Now, facing an amphibian tractor, the potential enemy would, of necessity, have to spread his defenses thin over a wider area of terrain. No longer were the natural inshore obstacles of coral an adequate or reliable adjunct to a viable beach defense system.[12]

Contemplating the capabilities of the new machine and bringing it into being were two very different things. It was 1937 and the budget of the Marine Corps was small. Besides, the vehicle was an unknown military quantity. In other words, it was a long way from the pages of *Life* to the beaches of Betio.

Still General Brodman thought enough of the concept to send Maj. John Kaluf to Florida to look the Alligator over and see if it would live up to its advance billing.[13] Major Kaluf was impressed. He was so impressed, in fact, that the result was a recommendation to the Commandant to procure a prototype. This recommendation stated in part: "... subject boat has possibilities for use in landing troops and supplies at points not accessible to other types of small boats."[14]

There followed nearly 2 years of struggle for the funds to build the prototype. The monies had to come from the Chief of Naval Operations, and he had none for that purpose.[15] The Navy was directing its limited resources for amphibious operations to the procurement of other equally important equipment, such as new landing craft and tank lighters.[16] Besides, Navy transports had been designed to lift a maximum of 5 tons over the side, and it was clear that the military version of the Alligator would go beyond that weight.[17]

With a war going on in Europe, Roebling, at the urging of the Marine Corps, designed the military version of his machine. He even sketched out a turreted (armored) model.[18] Funds soon became available to the Marine Corps for the construction of the prototypes. October of 1940 saw the first military amphibian delivered to the Marine Corps at a cost of $16,000. It was officially designated "Landing Vehicle Tracked (1)." Initial tests were successful, and the Bureau of Ships issued a letter of intent for the production of 200 steel-hulled, identical copies.[19]

By May of 1941 a tactical unit was established at Dunedin, Fla. to operate the new LVT. This amphibian tractor unit was, however, primarily concerned with the training of crews in the operations and maintenance of the machine. Although small numbers of LVT's participated in a few landing exercises in the last half of 1941, there really wasn't time before the attack on Pearl Harbor in December to develop any kind of doctrine for their tactical employment.[20] As they were part boat the planners of the day probably felt that these amphibians could be utilized in the same fashion as the landing craft.

So, as the United States entered World War II, the Marine Corps did have its long-sought-after vehicle that was capable of carrying troops and equipment directly from ships onto a hostile shore. Long before Colonel Ellis'

scenario would be played to its final conclusion, the tracked amphibian would have to earn its place in amphibious doctrine by the difficult trial-and-error method of combat. There was to be a rendezvous at Betio.

The experience at utilization of the AMTrac, or LVT, was acquired during the island assaults of World War II. As this experience was evaluated, on-the-spot doctrine was established. To this day, the lessons learned in the Pacific

LVT-1 (1941)

II—THE DEVELOPMENT OF A DOCTRINE

> The beach conditions forced on the Americans the use of an amphibian vehicle, and the vehicle influenced them to use a parade-ground system of approach. . . . it must be stressed that the LVT was used as a landing craft only because a landing craft could not negotiate a coral foreshore.[1]

In July of 1942 a group of New Zealanders was amazed as they watched a number of small craft emerge from the ocean and climb up on to the rocky shores near Wellington.[2] This landing on a friendly island beach was administrative in nature and required little doctrinal preparation. The amphibian tractor had arrived in the war zone and was about to earn its niche in the island war of the Pacific.

are the cornerstone of our LVT employment. Examine, if you will, the current publications of both the Navy and the Marine Corps, specifically NWP 22(B), *Doctrine for Amphibious Operations* and FMFM 9-2, *Amphibian Vehicles*, and compare the doctrine contained in them with the techniques used during the Pacific campaigns. It is readily apparent that these modern-day documents set forth the same tried and true procedures for the utilization of LVT's in combat that developed during the Second World War.

The validity of the present doctrine as it applies to the assault of fortified island surrounded by underwater obstacles is not in question. However, when it is applied to current scenarios with diverse objectives and where newer and more capable tracked amphibians will be employed, present doctrine is open to question. But in order to understand the present employment

doctrine, one must examine its origin and development.

Solomons and a Logistical Support Role. As a new implement, the LVT was thrust upon the operators and tacticians of the 1st Marine Division only a month before their initial amphibious operation of the war. It came with no handbook as to its uses. Some members of the division staff thought the LVT would be a handy gimmick for carrying supplies from ships offshore to inland dumps, and others, remembering its original capability for negotiating swampy terrain, saw it as an excellent mode to resupply frontline troops in the damp terrain of the jungle. With these roles in mind, the LVT assets of the AMTrac units were generally divided among the infantry organizations.[3]

From the very outset of the entire Marine effort in the Solomons, the LVT proved that its versatility was only limited by the user's imagination. Besides carrying all types of cargo to the point of need, it became a prime mover for artillery.[4] It also broke jungle trails, rescued pilots, became pontoons for bridges, and evacuated the wounded directly from the frontlines. On Bougainville, where a sea of mud nearly brought the operation to a premature halt, the LVT was the only vehicle able to keep the forward areas supplied. In fact, with numbers of LVT's available varying from a high of 64 to a low of 29, the 3d AMTrac Battalion transported 22,992 tons of equipment and supplies on that island alone.[5]

When the Solomons campaign was finished, the LVT was firmly established as an important adjunct to the logistical support of an amphibious landing. The Marine Corps had begun to write a small portion of the doctrine.

It is important to remember that throughout the Solomons campaign the LVT was not used to any degree as an assault troop carrier. Actually, the Commanding General of the 1st Marine Division recommended that the vehicle not be used in such a role, because landing troops would degrade its logistical usefulness.[6]

Tarawa and the Assault Role. Necessity is indeed the mother of invention, and the necessity to find a means to circumvent the coral reef surrounding the island of Betio at the Tarawa Atoll proved not only a testing ground for amphibious doctrine, but particularly for the techniques of employing LVT's in the role for which they had been designed—assault over the beach.

Reams of copy have been written on the subject of the Marine assault at Tarawa. They adequately point out the many lessons learned there and would, in part, include the need for better air and naval gunfire preparation of the objective area and a thorough hydrographic reconnaissance prior to "D-day." However, the most important lesson taught to the tacticians by Betio was that when a landing force assaults an island protected by an offshore reef, the use of LVT's is required.[7]

Beginning with the early planning stages of the Tarawa operation, the Amphibious Task Force Commander, Rear Adm. Richmond Kelly Turner, opposed the use of the AMTracs as assault vehicles for some very valid reasons. They were lightly armored, slow, difficult to control, and unseaworthy.[8] His evaluation was essentially correct, but they *could* cross reefs. With an uncertain high tide with which to float landing craft over the reef, Maj. Gen. Holland M. Smith insisted that they be employed in the first three assault waves.[9]

The assault proved essentially that both the admiral and the general were correct. The first three waves were equipped with 100 LVT's, 50 of which were tired veterans of the Solomons, while the others were the newer, faster, and better protected models of amphibian, the LVT-2. Nevertheless, they

had all the problems that Admiral Turner predicted. The older models could not keep pace with the newer ones, and the waves had to be slowed down to compensate. As a result, the waves were late crossing the line of departure.[10] Without any information as to the delay, a fault of communications, the naval gunfire was lifted on the original schedule. This left the Japanese defenders ample time to come out from their fortifications and prepare a lively welcome for the marines.[11]

It is significant to point out, however, that the LVT's, under heavy fire, advanced across the reef and placed the initial three assault waves directly on the beach with relatively light losses.[12] The heaviest casualties were sustained by the marines embarked in the landing craft. Those boats could not cross the reef, and, as a result, the embarked troops were forced to dismount and wade ashore under intense fire. Because the combat power that must always be built up rapidly in an amphibious operation did not materialize, the situation on shore remained in doubt for over 24 hours.[13]

History tells us that the desperate battle for Betio was won by the determined courage of those marines who got ashore and the LVT crews who not only brought them there, but kept them there by shuttling reinforcements and supplies over the reef. It was obvious to all concerned that there were barely enough LVT's available to turn the tide of battle.[14]

At the conclusion of the battle, some 3,000 dead and wounded marines were counted. Of that total a full 10 percent were from the crews of the amphibians. Vehicle losses were set at 71 out of the 125 eventually committed.[15] It was a very high price to pay for a new concept and the doctrine it developed.

The doctrine for LVT operations, established at Tarawa and executed during subsequent operations, consists of five primary tenets. First, when conducting an amphibious assault against a beach with obstructive offshore obstacles, the entire assault force must be boated in amphibian tractors.[16] Second, the troop-carrying waves must be preceded by armored amphibians, armored in the sense that they are equipped with a turret-mounted, large-caliber weapon to suppress beach defense fires.[17] The Marine Corps traditionally refers to this type of LVT as an armored amphibian. Third, a transfer line should be established seaward of the reefs or obstacles, in order that troops and equipment can be transferred from landing craft to LVT's.[18] Fourth, sufficient LVT's must be held in reserve to assist in the ship-to-shore movement of priority equipment and supplies. Fifth, a careful rehearsal of the landing must be executed to familiarize the LVT crews as to their exact missions.[19]

A full day before the Marine assault at Betio, the 165th Regimental Combat Team of the U.S. Army's 27th Division executed a landing on the island of Butaritari in the Makin Atoll. This landing, along with the one at Betio, was a part of the overall campaign to seize control of the Gilbert Islands chain. At Makin the Army contributed two very obvious principles to the growing LVT employment doctrine.

The first of these was the not so surprising concept of landing LVT's where the enemy had installed little or no beach defenses. At the same time, the 27th Division opted to configure its wave formation to facilitate rapid movement and better control. The assault waves used the inverted "V" formation as opposed to the standard on-line wave the marines used at Tarawa.[20] The results were a trouble-free ship-to-shore movement and a rapid buildup of combat power. Secondly, the Army employed its LVT's to land troops on the seaward flanks of the Japanese defenses by executing small-scale shore-to-shore amphibious landings.[21] This type of

employment exploits the mobility options available to the force after the assault landing is completed and the beachhead has been consolidated.

The results of the amphibious operations at Tarawa and, to some extent, at Makin convinced the Marine Corps that the LVT could and should be an important part of the amphibious assault force for the remainder of the Pacific War. Primarily, a refinement of the lessons and techniques learned in the Gilberts was to follow.

After Tarawa. The remaining island assaults that took place in the Pacific during 1944 and the first half of 1945 featured the use of large numbers of LVT's in the assault waves. Though no significant changes were made to the doctrine established as a result of Tarawa and Makin, numerous techniques of application had to be refined and improved.[22]

The Marshall Islands landings illustrated the validity of employing armored amphibians in front of the assault waves. These LVT(A)'s, with their turret-mounted guns, were able to take up where the naval gunfire had left off.

In addition, the operations in the Marshalls demonstrated that when large numbers of LVT's are utilized, a distinct command and control problem has to be dealt with. It was recognized that to solve this problem, better cooperation and coordination between the crews of the Navy's amphibious ships and the LVT personnel had to be effected.[23]

When the time came to capture the strategic islands of the Marianas, the full focus of the Marine Corps experience at employing LVT's could be applied. Newer, faster, and more protected vehicles were directed at the beaches in the on-line wave formation. As in the past, the traditional coral reef protected the selected landing beaches. This time, however, at least at Saipan, the LVT's assigned to carry the assault elements of the 4th Marine Division were directed to move inland some 1,400 yards before debarking their troops.[24] This new tactic was intended to allow for a more rapid advance inland and would lessen the congestion on the beach which usually slowed the beachhead development.

This first attempt at an amphibious armored column failed in its intended purpose. Because of the heavy concentration of gunfire directed upon them, only an ineffective few of the LVT's were able to move inland. As a result, a new concept in employment of LVT's was prematurely discarded.[25] The principle of breaking through a beach defense by shock action and then exploiting that breakthrough by attacking to the rear and to the flanks of the position, can, however, have a definite place in an amphibious doctrine.

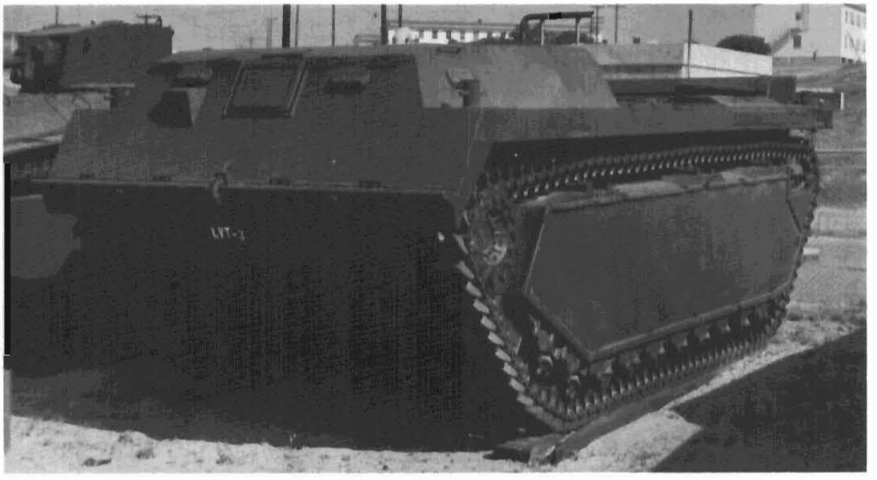
At Tinian the use of LVT's in conjunction with other landing craft allowed the landing force to select a narrow and restrictive beach that was undefended. The ability of the amphibian to move directly inland off the beach made this normally undesirable landing site usable for the assault. The Japanese, on the other hand, had prepared in-depth defenses of the logical landing beach near Tinian Town.[26] The outcome was never in doubt.

The success of the undertaking at Tinian can be measured in terms of low casualties and the swift capture of the island. The flexibility and the mobility offered by the amphibian allowed the beach defense system to be outflanked, and troops and supplies could be rapidly moved inland off the beaches. It is an important lesson not to be forgotten.

The remainder of the amphibious war in the Pacific would see the principles established for LVT assault executed on an even more massive scale. Although they were epic struggles, no real changes or additions to the now confirmed doctrine would be made. The doctrine did work.

At Iwo Jima, for example, nearly

500 LVT's placed 6,500 assault troops ashore in the first 30 minutes of the operation.[27] Later, at Okinawa, the mobility provided by the LVT's exploited the undefended beach conditions found there and allowed the Army and Marine assault forces to build up their combat power ashore. Hard fighting was ahead for the landing force, but the actual amphibious landing was considered by many as "the war's greatest anticlimax."[28] Although the numbers of LVT's committed were greater in these final operations, the doctrine, as developed at Betio, refined in the Marshalls, and exploited in the Marianas, was used. The picture of the wave after wave of troop-laden amphibians churning toward an island beach is a familiar one to newsreel watchers and illustrates this doctrine clearly. Take that same picture, reduce the numbers of LVT's, add some helicopters in the background, and today's doctrine would appear.



LVT-3 (1943)

Post-World War II Developments. As with all American wars, when the end comes, the cutback starts. This was certainly true after the Second World War, and it affected the amphibious forces just as it did many other aspects of the U.S. military.

As the war had ended in a mushroom cloud, many military thinkers in high places felt that the nuclear age spelled the end of the massive concentrated assaults on enemy beaches. As Marine Col. J.D. Hittle in his article "20th Century Amphibious War" states: "Hardly had World War II victory been achieved, than a large element of military thought again manifested its gratuitous willingness to declare amphibious warfare and naval power obsolescent and unresponsive to the requirements of modern war."[29]

The effects of the normal postwar reduction of forces and the feeling that amphibious warfare was over the hill as a military instrument were felt in the world of the LVT. By 1950, of the more than 18,000 AMTracs built during the war, only 1,200 remained in the active forces.[30] It would take another war, this time in Korea, to bring back the amphibious operations and with it the LVT.

The amphibious assault on the port of Inchon, Korea, has been described by many as the perfect amphibious operation. Besides being a stroke of strategic genius, the operation represents the high water mark in the application of the LVT doctrine as conceived in the Paci-

fic. Carrying part of the assault waves of the 1st Marine Division ashore, the AMTracs moved through tidal mud flats, crawled over obstacles, and placed their cargo of marines in position to seize the objective.

Summing up the overall effect of this operation on the future of the amphibious operation, Comdr. Malcolm W. Cagle in his article "The Analysis of a Gamble" concludes: "While Inchon's basic pattern was unchanged, and while there were no new techniques or doctrines developed, the assault confirmed the soundness of our present doctrines and demonstrated afresh the power of decision which the amphibious assault possesses."[31]

During the early 1950's, while the Korean war was still in progress, the Marine Corps designed and tested a new LVT with which to replace the World War II types that were still in the inventory. This model, the LVTP-5, was adopted for service use and was introduced into the Fleet Marine Forces in 1956. A comparison between the LVTP-5 and the AMTracs built during the Second World War is shown in table I. The vehicle represented a significant improvement over the previous models.[32] It was more capable of operating on land, provided more protection for the embarked troops against shell fragments and small arms fire, and could carry much more cargo than its predecessors. The LVTP-5, along with four other types of LVT's built on the same hull,[33] is still the standard amphibian of today's landing force.

While the only change to the LVT portion of the amphibious operation during the postwar years was in equipment, the operation itself was given a new dimension of employment with the advent of the helicopter and the vertical assault. Doctrine for the use of this new tool was established based on experience gained in Korea and from exhaustive tests conducted during many operational exercises. When used in conjunction with the surface assault, it provides for some flexible, rapid, and powerful combinations with a number of options.[34]

Since mid-1965 amphibious landings have been made up and down the coast of South Vietnam. These landings are conducted using both the vertical and surface assault techniques in combination. The helicopters land their troops behind the beach, while troops embarked in LVT's move ashore in wave formation to establish a beachhead. Once the beachhead is established and the heavy combat support units of tanks and artillery are ashore, the force moves out of the beach area and joins the helicopter-landed elements.[35] Although this short description is oversimplified, it represents the state of the doctrinal art today. Modern in one sense, archaic in another, this doctrine has been successful in a counterinsurgency war. It is hard to argue with success, but, for the future, it may be fatal to stand on today's LVT doctrine in its present form.

LVT Doctrine Today. The specific principles for the employment of the tracked amphibian can be found in the previously mentioned FMFM 9-2. There will be no attempt here to list and dissect all of them. Many of the principles pertain to individual and small unit tactical operations of the AMTrac. Others deal with safety precautions and organizational matters. These principles are valid under any doctrine. What needs to be considered, in the light of modern military developments, is that portion of the doctrine which deals primarily with the ship-to-shore movement.

Figure 1 graphically shows the LVT in the ship-to-shore evolution. All the familiar elements are present, the line of departure (LOD), which is an imaginary line offshore parallel to the landing beach from which the waves are dispatched to shore; the primary and

TABLE I—LVT's: 1941-1969[a]

Model	Year	Weight (lbs)	Speed (mph) Water/Land	Capacities Troops/Cargo
LVT-1	1941	17,000	5/10	18/4,000 lbs
LVT-2	1942	24,400	6/16	24/8,000 lbs
LVT-4[b]	1943	25,650	6/16	35/8,000 lbs
LVT-3	1943	32,000	6/20	35/7,000 lbs
LVT-3(C)	1949	39,190	5/20	35/6,100 lbs
LVTP-5	1956	69,780	6.8/30	Water: 34/12,000 lbs Land: 34/18,000 lbs

[a]Maynard M. Nohrden, "The Amphibian Tractor, Jack of All Missions," *United States Naval Institute Proceedings,* January 1946, p. 17; U.S. Marine Corps, *Amphibian Vehicles,* FMFM 9-2 (Washington: U.S. Govt. Print. Off., 1965), p. 182-183.

[b]LVT-4 was in operational use before the LVT-3.

secondary control ships which *anchor* astride the LOD to control the movement and timing of all the waves moving ashore; the many wave guide boats which round up the amphibians, get them formed, and control their speed and direction in the move to the beach; and the LVT's which form into the traditional on-line waves.[36]

The gathering together of the various elements described, in order to place marines on the beach, is a time-consuming process. Normally, the naval units shown in figure 1 are in position anywhere from 1 to 2 hours prior to the assault. Allowing for an LOD 4,000 yards from the beach, it would take the LVT's, at the very minimum, 20 minutes to cover that distance. Basically, this means that the force has lost an element of surprise and at the same time offered an enemy a lucrative target.

Once ashore the LVT's drop off their infantry who secure the beachhead. The LVT's move to the flanks of the beach to get out of the way of the following waves and wait for other missions. A potentially mobile force becomes temporarily immobile. Usually, once the tank units come ashore and the beach area has been secured, a column is formed containing tanks and infantry mounted in LVT's to link up with the forces landed inland by helicopter.[37] In this manner the surface-landed elements are connected to the air-landed elements, and an old doctrine is attached to a new one.

The old doctrine has been successful in the past, mainly because it was tailored to fit the particular type of terrain and enemy that it actually encountered. Today, joined with the helicopter doctrine, it is succeeding against an opponent who hasn't the modern weapons to effectively oppose it. What about the other potential enemies in this world? Could they pose a real threat to the amphibious forces under its present concept?

III—BACKGROUND FOR A NEW DOCTRINE

> The national military strategy will . . . be essentially peripheral, with U.S. strength deployed forward to the littorals of the Communist world. Sea power will be the primary means for the movement and support of balanced U.S. forces overseas. The line of Free World defense will be on the coastal areas around the perimeter of the aggressor nations. In this

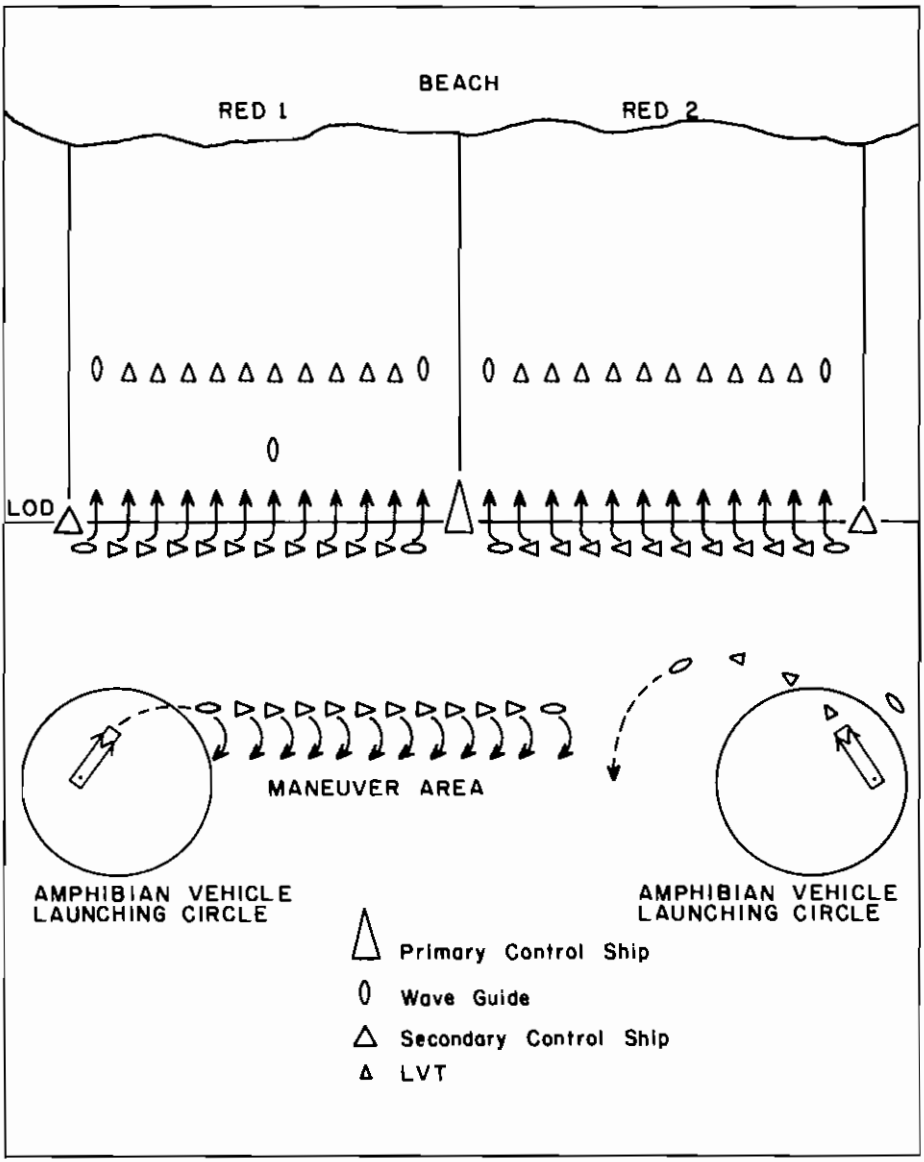


Fig. 1.—Ship-To-Shore Movement of LVT's, Today.

peripheral, littoral strategy, amphibious capability is expected to be a crucial element.[1]

It would be presumptuous to think that the LVT will have any effect on national maritime strategy, but, conversely, this strategy will affect the type of modern doctrine needed to properly employ the LVT in support of it.

The overall Marine Corps role in the maritime strategy of the United States is to use its balanced air-ground landing forces to rapidly project its combat power ashore in any area of the world and against any type of adversary.[2] The capability to perform this role in all levels of conflict is a strategic weapon against which, when used, no enemy has the ability to retaliate in kind.[3] Since World War II this weapon has been used with great effect in all levels of conflict short of nuclear war. Without a doubt, it will be used again.

Modern Technology and Old Doctrine. To employ our amphibious weapon in the future with the same probability of success we have enjoyed in the past will be more difficult. The plain fact of the matter is that time, events, and military technology have overtaken the old LVT doctrine. It is folly to believe that the old methods will continue to succeed against a potential enemy who may possess modern weapons, mechanized mobility, and a diverse geographical rimland. These factors, properly used against an amphibious force, could counter the forces' ability to rapidly build up its combat power ashore. This premise would be particularly true if the amphibious force follows the present time-consuming procedures of immobilizing its shipping close ashore while launching amphibian vehicles and landing craft. It is during this period that the very heart and lifeline of the operation lie vulnerable to destruction by a formidable "mixed bag" of enemy weapons.

Once ashore the landing force could likewise be subjected to destruction by an enemy aggressively employing his armored units against the beachhead.

Threats to the Ship-to-Shore Movement. A lengthy recounting of all the weapons and tactics that could be brought to bear on the amphibious forces is not intended here. What is intended, however, is to examine an enemy's general capabilities to prevent the landing force from executing the ship-to-shore movement.

The Soviet Union and her allies have the capability to thwart an assault from the sea. The vulnerability of immobile shipping to the Soviets' sophisticated antiship missiles launched from the sea, the shore, and from the air is well known. So also can submarines and shore batteries pose a significant threat to the amphibious force.[4] It is conceivable that the operation could be brought to a premature end before the LVT's could be launched.

The Soviet doctrine for the organization of a beach defense against an amphibious assault should be looked at. It is clear that the Soviets have done more than a little doctrinal development to counter the threat of a landing against their exposed coastline.

A significant insight into their thinking was revealed in an article describing Soviet seacoast defense published in *Voennyi Vestnik* (Military Courier), an organ of the National Defense Ministry.[5] In general, the beach defense system was characterized as an area defense of accessible landing sites. These sites would be defended by motorized or mechanized units with each battalion of these units responsible for a position extending 2,600 to 3,000 meters in length and 2,000 meters in depth. A less accessible landing beach would extend the battalion's front out to 5,000 meters or more. These defenses have all the heavy weapons associated with Soviet motorized and mechanized units—tanks,

artillery, and antitank guns. Mines of all types are employed both on and off shore.[6]

The most interesting and meaningful indication of the Soviet beach defense concepts comes from the following statements:

> Fire (support) systems should interfere with the enemy at the farthest possible approaches, ... Enemy amphibious landings may coincide with an airborne landing by helicopter. In all instances first priority is assigned to combating the amphibious operation . . .. Counterattacks in defense of the seacoast can and should be conducted by second echelon forces as soon as possible.[7]

It is clear that the Soviets regard the air-landed forces as less of a threat, probably because these forces are without heavy weapons and ground mobility. They can be dealt with later.

In an attack on a Soviet-style beach defense system, the amphibious landing forces should fully expect to be engaged by the defender; (1) at sea prior to the commencement of ship-to-shore operations; (2) during the ship-to-shore movement; (3) immediately upon reaching the beach by both his fixed and mobile defenses; and (4) before a beachhead can be consolidated by means of a mechanized counterattack.

The excellent capabilities of Soviet armor are well known, and the mobility of this armor well demonstrated. Marines in the amphibious assault have never had to cope with armored forces of this kind before, and the prospect of doing so could hardly be greeted with enthusiasm.[8]

Consider the dimension of the problem from the viewpoint of the amphibious force if nuclear weapons were employed by the defender. The ships close ashore and the congested beachhead offer a tempting target for the employment of such a weapon. The effects under the present doctrine would be catastrophic.[9]

There is no doubt that the forces of the Soviet Union would present the most serious problem for the landing force, but Soviet allies, especially in the Middle East, and Communist China in Asia have the capabilities of effectively menacing any amphibious operations within their geographic spheres.[10]

Geography: a Problem for the Defense. In the previous chapter it was pointed out that the doctrine for LVT employment was developed to some extent around hydrographic and topographic conditions found in the geographic area of operations. Today's published doctrine emphasizes the importance of geographic suitability right along with the capabilities of the defenders.[11] The factor of geography will remain constant when examined in the light of any new doctrine. For example, it would be foolhardy to select landing beaches fronted by sheer cliffs with no routes of egress inland.

Col. Robert D. Heinl, writing in the *United States Naval Institute Proceedings*, envisioned Eurasia as one great landmass surrounded by sea and presenting an exposed coastline eight times that of the United States which is vulnerable to an attack from the sea.[12] It would take another research effort to study the various beaches of the world to determine the extent of suitable landing sites. A rough map reconnaissance does back up the colonel's statement.

The effect of long expanses of exposed coastline on the defensive measures taken by a potential enemy are many. He must defend the littoral regions close by his vital areas and installations. He must also have the flexibility to thwart any attempt to flank and invest these vital areas. To accomplish these ends the defender can establish an area beach defense system around po-

tential objectives of the landing force. He may, on the other hand, elect to rest his defense on a mobile response combining a standoff attack on the landing force before, during, and after the ship-to-shore movement, to be followed by a mechanized counterattack early in the buildup ashore. The defender also has the option of combining these courses of action into one.

Obviously, an enemy with a long coastline to defend is at a disadvantage. He cannot physically cover all his area with on the ground defenses without weakening his overall effort. It is reasonable to assume that he must rely to some degree on a mobile reaction force to either reinforce his beach defenses or to counterattack the landing force in its early stages of buildup ashore.

Mobility Is the Name of the Game. The amphibious force will always have the initiative as to the time and place of the attack. Initially, it has the advantage of mobility at sea, but under present doctrine, once this force is committed to a specific landing area, the mobility is lost.

It is an established fact that the speed of the ship-to-shore movement has not increased since World War II.[13] However, the ability of an enemy to destroy the landing force during this evolution has increased. Link these facts with an assortment of geographical conditions, unsettled world tensions, and unpredictable enemies of all descriptions, and the requirement to modernize the conduct of some portions of the amphibious operation becomes apparent. The Navy and the Marine Corps must be able to maximize to the greatest extent possible the inherent mobility available to the amphibious forces.

It is easy to rationalize the entire mobility problem by pointing to the third dimensional aspect of the force, the helicopter. It gives the force mobile and flexible opportunities to land troops rapidly to the flanks and to the rear of the beaches as well as to seize important objectives deep in hostile territory.[14] In this kind of role the helicopter has more than proven itself. It has become as much a part of the amphibious operation as the surface assault elements.

Alone in a counterinsurgency environment, the helicopter can be very effective, but alone on a conventional or nuclear battlefield, the marines landed by helicopter would be at a distinct disadvantage without the heavy weapons and the ground mobility necessary to defeat a mechanized enemy.

The modern amphibious landing force must have the speed and mobility at sea and on the ground to match and augment its air-landed elements. A modern amphibian, properly employed, can add the needed speed and mobility to the surface assault force. Let us change the name of the game for the LVT from obstacle crossing to surface mobility.

IV—FAST AMPHIBIAN DELIVERY: A DOCTRINE IS PROPOSED

> The success of any amphibious operation may depend on flexibility and mobility of the landing force. Diversified means of effecting a ship to shore movement and supporting subsequent operations ashore are essential to the success of the amphibious operation. A diversification of amphibian vehicles supporting varying situations in the amphibious assaut . . . magnifies the enemy's problems in defending against amphibious operations.[15]

Although this statement prefaces the *Fleet Marine Force Manual* which sets forth the present doctrine for LVT employment, it could aptly be suited to new doctrinal concepts without changing a word. Unquestionably, the foundation of any new proposal for change

must rest on "flexibility and mobility of the landing force."

The previous chapters discussed the origins of the LVT, the combat-developed concepts for its employment, and the need for a change based on a recognition that a potential enemy may have a wide variety of military capabilities to defeat an amphibious assault. Furthermore, it has been pointed out that the proven mobility of the helicopter-borne assault forces needs to be complemented by an increase in the speed and mobility of the forces put ashore by surface means.[2]

Basic Requirements. Just as any modern doctrine must be responsive to any number of scenarios of war, from the low-level guerrilla conflict to the nuclear war, in the case of the LVT it must be tailored to contain sufficient speed, mobility, and power to accomplish all amphibious missions assigned. Above all, a new doctrine must be postulated on a viable means of execution. Thus, in order to support a proposal for a new LVT doctrine, an examination of the ships and vehicles necessary to carry it forward is essential.

Twenty-Knot Amphibious Shipping. Increasing the speed of the landing force must first begin at sea. Today, the U.S. Navy is rapidly acquiring the capability to carry ground forces to an objective area at 20 knots. The fast amphibious ships capable of embarking and debarking LVT's are the Amphibious Transport Dock (LPD), the Thomason Class Landing Ship Dock (LSD), and the 1179 Class Landing Ship Tank (LST).[3]

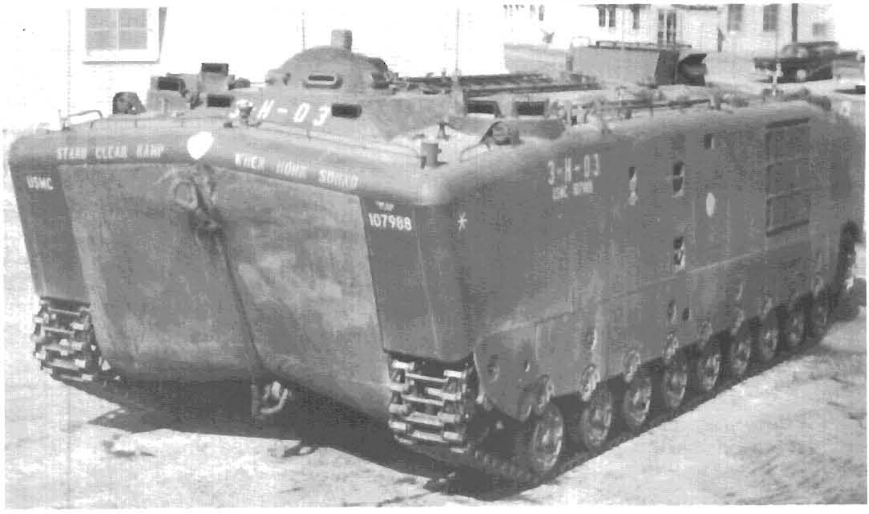
The three classes of ships mentioned are all equipped with stern ramps, allowing for the rapid debarkation of the amphibians. Both the LPD and the LSD have the demonstrated capacity for launching LVT's while fully underway, and it is hoped to demonstrate the new LST's capabilities in this regard at an early date.[4]

These 20-knot ships give the naval forces the needed speed and mobility to reduce their vulnerability at sea, while at the same time delivering their cargo of LVT's to the objective area.[5] The near future holds the promise of more ships along the same lines.

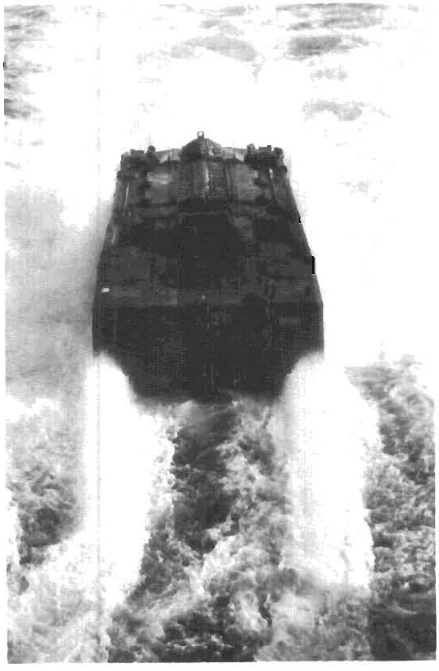
Today's Amphibian. Chapter II indicated that the Marine Corps is presently equipped with a family of amphibian tractors designed around the standard personnel and cargo carrier, the LVTP-5. In 1956 this model of LVT was introduced into the Marine Corps operating forces and represented a quantum jump in all-ground capabilities over the World War II and Korean war models.[6] These improved capabilities manifested themselves in better overland speed, larger troop and cargo capacities, vastly superior sea-keeping and surfing performance, and heavier armor protection against shrapnel, small arms fire, and the effects of nuclear radiation[7] (table II).

For its time, the LVTP-5 was an excellent amphibian. It complemented the M-48 medium tank in speed and range and performed some of the duties of an armored personnel carrier. This amphibian can still offer a degree of speed and mobility to a fast amphibious assault force.

Unfortunately, the effects of 13 years of continuous service are showing. In addition to age, the vehicle's inherent limitations due to the compromise between the land and water capability, together with certain glaring weaknesses of the vehicle discovered in extended operations in Vietnam, degrade the LVTP-5's ability to play a role in a fast mobile amphibious assault. Examples of some specific limitations and weaknesses include: (1) Maintainability of an aging piece of equipment; (2) High fuel consumption rates of 2.4 gallons per *mile* on land and 47 gallons per hour in the water; (3) Limited speed and maneuverability while waterborne; (4)



LVTP-5 (1956)



LVTP-5

Presents a large, flat, vertical, and horizontal target to enemy gunners; and (5) High vulnerability to antitank mines due to the location of the fuel cells in the bilges of the vehicle. When an LVT contacts a mine, the gasoline in these cells (456 gallons) almost always ignites and detonates.[8]

It is not surprising, then, that the Marine Corps has a new tracked amphibian under development and test at this time. This new LVT should be ready for introduction into the Fleet Marine Force by fiscal year 1972.[9]

LVTPX-12: Implement for a Change in Concept. Near the end of September in 1967, at the facilities of the FMC Corporation in San Jose, Calif., this writer watched an odd-shaped tracked vehicle speed around a test track at 40 miles per hour, navigate a manmade pond in excess of 8 knots, and while still waterborne stop and turn about within its own axis. The vehicle was the first prototype of the LVTPX-12. It will eventually be configured into four other types of amphibians.[10]

To date, 14 PX-12's, 1 CX-2, and 2 RX-2's have been delivered to the Marine Corps for test and evaluation. So far, indications are that the vehicle will live up to or exceed its advertised specifications.[11]

A close inspection of the impressive characteristics of the LVTPX-12 (table III) points out the advantages of this

TABLE II—CHARACTERISTICS OF THE LVTP-5*

General	
Crew	3
Troops	34
Armament	(1) 30 cal. Machine Gun
Weight w/12,000 lb. load	81,780 lbs.
Ground Pressure	8.59 psi
Fuel Capacity	456 gals.
Performance	
Range, land @ 20 mph	190 mi.
water @ 6.8 mph	57 mi.
Speed, land	30 mph
water	6.8 mph
Forward Slope	70%
Side Slope	60%
Trench Crossing (width)	12 ft.
Vertical Obstacle (height)	3 ft.
Dimensions	
Length	29 ft. 8 in.
Width	11 ft. 8½ in.
Height	10 ft. ½ in.
Cargo Compartment, length	15 ft.
width	7 ft. 3 in.
height	5 ft. 6 in.
Engina	
Make and Model	Continental (gasoline V-12)
Displacement	1,790 cu. in.
Horsepower	810 hp.
Transmission	
Make and Model	Allison 850 Cross-drive
Speed Ranges	2 speeds forward; 1 reverse

*U.S. Marine Corps, *FMFM 9-2,* p. 181-184.

vehicle over the LVTP-5. Any number of comparisons could be made between them, but, primarily in the context of implementing a new concept, the foremost advantages can be listed as speed in both environments, a less volatile fuel (diesel), a less vulnerable location of that fuel, longer range, and a significant increase in mobility and maneuverability, particularly in the water.[12] The only trade-offs in capabilities have been in the troop and cargo carrying capacities. As far as maintainability is concerned, the LVTPX-12 requires only one-third the man-hours of maintenance required by the older LVTP-5. This is an important factor when considering sustaining a fast-moving and prolonged amphibious campaign.[13]

Clearly, by fiscal year 1972, the amphibious forces of the Navy and the Marine Corps will have the ships and amphibians with which to mold an efficient and modern force. The coral atolls which brought forth the LVT may well be gone forever as amphibious battlefields. The time is ripe for a change.

Some Proposals for Change. The need for a change in the method of assaulting across an enemy beach has long been recognized and discussed in detail in military periodicals of the

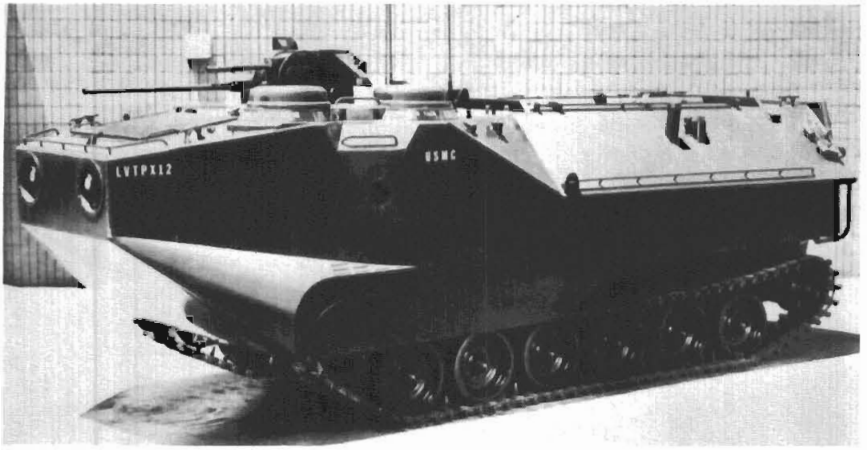
post-World War II and Korean war periods. The principal concern of the writers was the danger to the beachhead from an armored counterattack.[14] As time passed, the concern of some military thinkers directed itself *toward the vulnerability* of the entire amphibious force to nuclear weapons and the guided missile. Several authors decried the lack of speed with which the ship-to-shore movement is executed.[15] However, very few proposals which can be considered within the realm of plausibility have been proposed. Of the propositions for a change, only three of them offer some attractive possibilities for use in developing a new concept for the employment of LVT's.

The first of these is the direct delivery of LVT's and tanks to the beach by LST. This procedure would eliminate the ship-to-shore movement for the slow

TABLE III—CHARACTERISTICS OF THE LVTPX-12*

General	
Crew	3
Troops	25
Armament	20 mm. Rapid-fire w/coaxial 7.62 mm. M.G.
Weight w/10,000 lb. load	50,000 lbs.
Ground Pressure	7.7 psi
Fuel Capacity	180 gals.
Performance	
Range, land @ 25 mph	300 mi.
water @ 8 mph	70 mi.
Speed, land	40 mph
water	8.4 mph
Forward Slope	60%
Side Slope	60%
Trench Crossing (width)	96 in.
Vertical Obstecle (height)	36 in.
Dimensions	
Length	26 ft.
Width	10.5 ft.
Height	10.3 ft.
Cargo Compartment, length	14 ft.
width	6 ft.
height	5.5 ft.
Engine	
Make and Model	Detroit Diesel V-8
Displacement	424 cu. in.
Horsepower	400
Transmission	
Make and Model	FMC HS 400
Speed Ranges	4 speeds forward, 2 reverse
Water Propulsion	
Primary	Water Jets
Secondery	Tracks

*FMC Corporation, Ordnance Division, *LVTPX-12, Assault Amphibian Personnel Carrier* (n.p.: 1968), p. 4.



LVTPX-12

amphibian and allow for the immediate employment of tanks at the beachhead line. It was considered that the LST was no more vulnerable to enemy attack while beached than it was while anchored offshore in a transport area.[16] The disadvantages to this proposition are principally that it limits the selection of landing sites to those which hydrographically support the LST and that a significant portion of the landing forces' eggs would be in one basket without the ability to maneuver independently under fire.

The second of the concepts is probably the most imaginative and may be an answer to the problem in the future. The proposal is for a 60-knot landing force capable of placing both troops and heavy mechanized units ashore at that high speed. The principal vehicle involved in this doctrine is the Surface Effect Ship (SES). Some smaller models of this type of hovercraft are operational today, but the vehicle intended to support this concept is still in the development stage. It is envisioned that the giant SES's would be launched from amphibious ships positioned over the horizon from the landing beach. It is claimed that the SES is not affected by high sea state or heavy surf. With this vehicle the landing force could execute a 60-knot ship-to-shore movement and have the troops, tanks, and LVT's together, ready to deal rapidly with an enemy's armored counterattack forces.[17] The only disadvantage to the proposal is that at this time, or in the near future, the SES will not be available to the landing force. It could be a concept for the 1980's, however.

The last proposed concept which requires an examination, in the light of new doctrine for LVT employment, is that of a quick amphibious reaction force. This proposition is based around the utilization of the LPD as a base of operations for a Marine Battalion Landing Team (BLT) to conduct amphibious operations. The BLT with its LVT's and its helicopters would launch both surface and air assaults on an enemy beach from the same ship. The LPD is capable of supporting such a force for a sustained combat period ashore of 15 days. The real advantage of this proposal is that the BLT commander's command and control problem is simplified by locating his diverse elements on one ship. Along with the basic concept, this proposal includes a technique for launching LVT's from the LPD while fully underway to reduce the vulnerability of the ship-to-enemy missiles, submarines, and shore batteries.[18] This

underway launch technique, although not entirely new in conecpt, offers an attractive foundation upon whieh to build a new doetrinc for LVT employment.

The Underway Launeh: a Foundation for a New Doctrine. The proeedurcs for an LVT to dehark from an LSD or an LPD whilc the ship is on the move havc been testcd and found completely feasihle. As early as 1965 the Marine Corps and the Navy were involved in perfeeting the techniques to be employed by both the ship and the amphihian in such an evolution. Through a series of tests, reliable proeedurcs have been estahlished.[19]

For the sake of an example, consider an LPD underway at 20 knots. It lowers its stern gate to a point level with the well deek within which the LVT's, ready for launch, are located. The ship ballasts down so that only 12 to 18 inehes of water cover the stern gate and the after portion of the well deck. The ship is then ready to launch its amphihians. At this point, the LVT's roll down the well deck under full power, gaining momentum so that when eaeh vehiele passes out through the ship's stern it will have sufficient speed to get free of the turbulenee of the water aft of the stern gate.

Any number of LVT's, up to the eapacity of the LPD, can be launched in this fashion. An illustration of one of numerous launch possibilities wonld be two eolumns of 10 LVT's eaeh, debarking from the ship at the same time. With a launch interval of 4 seconds between vehicles in each column, two separate waves of LVT's would be lined up and ready to proeeed to the beaeh in a little more than half a minnte. Meanwhile, the ship itself has been underway at near flank speed during the entire evolution. Not only is the ship-to-shore movement speeded up, but the ship is less vulnerable to hostile action.

The other side of the ship-to-shore coin is the movement of the LVT's from the launch point to the beach. Once the vehicles are waterborne, the speed of this movement hecomes a factor of the speed of advance of the amphibians and the distance from the launeh point to the beach. To shorten the time of this evolution, technology has increased the speed of the amphibian. The LVTPX-12 has a rate of advance in the water of 230 yeards per minute, while the LVTP-5 moves at a slower 198 yards per minute.

The obvious option available to shorten the distance to the beach would he to bring the launching ship in eloser to the shore for the debarking of its amphibians. Under the present doctrine LVT's are launched from a stationary point anywhere from 500 to 1,000 yards seaward of the line of departure. The line of departure is usually set at 4,000 yards from the beaeh.[20] Not ineluding the time necessary for the LVT's to rendezvous and form into waves, the movement time to the shore for each of these waves is 22 minutes at the minimum.

Consider the possibility of the underway launeh of these same LVT's along the LOD at 2,000 yards from the landing beach. In this case each wave could be ashore in 9.2 minutes.[21] This proeedure would significantly shorten the exposure time for hoth the amphibious ships and the portion of the landing force embarked in the LVT's.

Controlling waves launehed in this fashion poses some speeial problems. Certainly, it would not be feasible to launch and reeover wave guide boats while the ship is moving at 20 knots. Nevertheless, the requirement still remains to guide the waves of LVT's to a proper landing site on the beach, as well as to control the speed of advance of the waves so that they arrive at the shoreline at a time whieh closely coineides with the lifting of the shore bombardment. Why not utilize a helieopter for this purpose? Properly

equipped, this versatile machine could move along with the waves of LVT's, controlling their movements by means of voice radio circuits, and marking the center of the landing beach with smoke rockets. These airborne wave guides can operate from the launch ship, thus simplifying the pre "D-day" briefings and coordination. Another bonus feature, which might be worth exploring, is the capability of these same helicopters to provide some sort of additional fire support for the assault waves as they touch down on the beach.

Formations used by the LVT's after launch can generally take two basic forms. As illustrated by figure 2, the LPD or LSD moving along the LOD debarks the vehicles so that they are lined up in a column moving in the opposite direction from the track of the ship. From this position the LVT's have the option of executing a flanking movement and proceeding ashore in the traditional on-line formation or turning in towards the beach and moving the entire distance in a column. Of course, the on-line formation offers the optimum dispersion of forces and should be used if the landing is opposed at the beach. The column formation should be considered if the landing is to be made under conditions of low visibility where control of the wave may prove difficult. The column can also be employed where the landing would not be opposed at the beach and the need for rapid deployment of the force inland is anticipated. The assault force, without stopping at the shoreline, could move directly inland to seize vital areas, reinforce helicopter-landed forces, or engage a mobile defense unit of the enemy.

The unique advantages of the underway launching of LVT's over the present stationary launching methods are impressive. Primarily, the speedup of the ship-to-shore movement and the reduced vulnerability of the amphibious shipping stand out. The disadvantages foreseen are minimal. The command

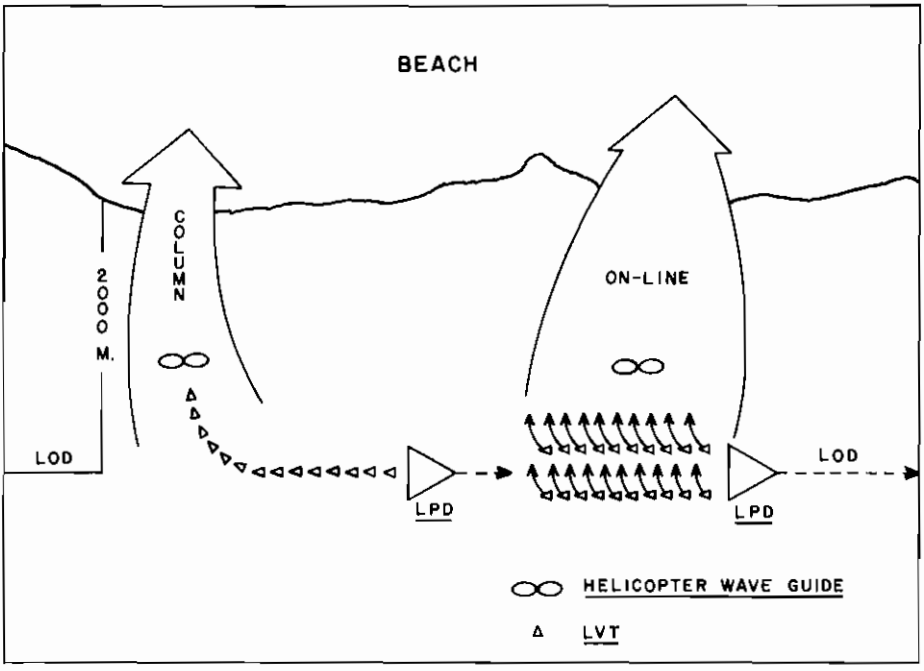


Fig. 2.—Underway Launch of LVT's.

and control problem can be overcome by the use of helicopters as wave guides. Weather and sea state may prove more critical when launching underway, but these considerations also have a significant effect on the present doctrine.[22]

Using the technique of underway launch, together with increased capabilities offered by the LVTPX-12 for ground mobility, a doctrine can be proposed which may allow the tracked amphibian to play a more useful role on the modern battlefields of the 1970's.

Fast Amphibian Delivery (FAD): a Proposal. Broadly conceived, a new doctrine for the employment of LVT's would have to provide for: (1) Speed and maneuverability of the landing force; (2) An organization of resources with sufficient combat power to defeat a fixed beach area defense system; (3) Sufficient flexibility to either neutralize or destroy a mobile enemy force in the landing area; and (4) The rapid reinforcing of the helicopter assault units. It must be recognized that the LVT is but a means to deliver combat forces to a point of application in an objective area. Infantry, tanks, artillery, naval gunfire, and close air support are required ingredients which must be present in any amphibious operation.[23] With these elements available as constants, a fast amphibian delivery concept can be proposed.

The cornerstone of the concept is the underway launch previously discussed. This technique satisfies the speed and maneuverability requirements of the new doctrine. In order to provide for the remainder of the criteria, it becomes necessary to organize the surface assault forces embarked in LVT's into three basic units, a Beach Assault Force (BAF), a Mobile Attack Force (MAF), and a Link-Up Force (LUF). As indicated by their titles, each of these forces would be tasked to accomplish a portion of the overall amphibious mission.

The BAF would be assigned the primary mission of seizing the beachhead, to hold and defend it so that follow-on forces and vital logistics could be brought ashore. It would have to be capable of assaulting a fortified beach defense as well as consolidating its positions rapidly once the initial resistance is overcome.

The MAF is the maneuver element of the landing force. Its mission would be twofold: (1) To land on the flanks of the BAF to support that force in the securing of the beachhead, or (2) To move directly inland and seek out and destroy any enemy mobile force which could threaten the beachhead operation.

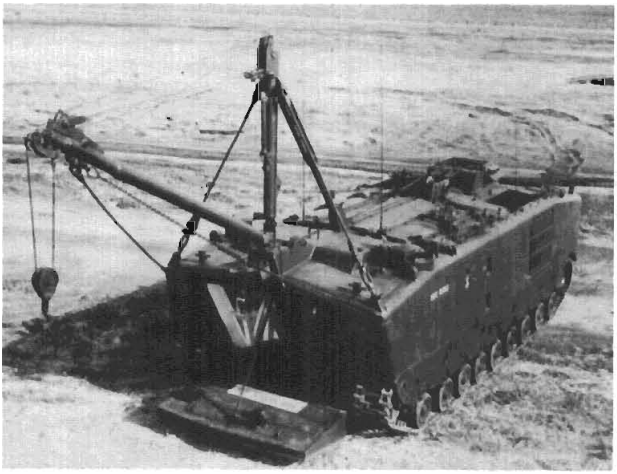
The LUF is the reinforcing element of the landing force. Its primary mission would be that of breaking out of the beachhead area and rapidly moving inland to join the helicopter-landed units. The LUF will provide these air-landed elements with much needed heavy combat power and ground mobility.

The LVT composition of these three components will vary with the size of the landing force and the situation which may be encountered ashore. The number of troop carriers depends on whether a Battalion Landing Team (BLT), Regimental Landing Team (RLT), or larger forces are to be employed. The number and disposition of the LVTH, with its 105 mm. howitzer, and the LVTE, with its mine clearance apparatus, will depend on the enemy situation. Generally, the BAF will have the preponderance of these vehicles supporting its assault on a defended shoreline.

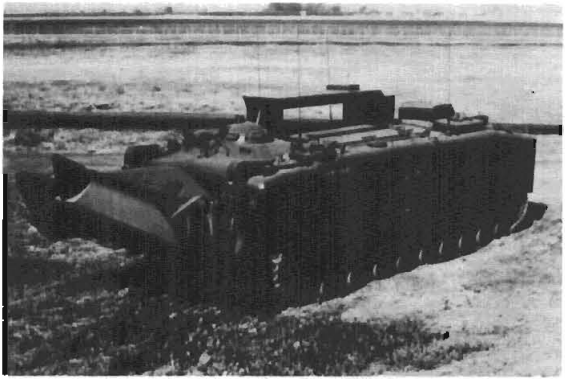
The real "fly in the ointment" for the MAF and, to some extent, for the other forces is the immediate availability of tanks ashore. This problem has plagued planners for many years. The LVTH has a limited antitank capability, but it is too lightly armored to slug it out with enemy tanks.[24] Close air support can assist in the interdiction of enemy armored units. But when it comes to engaging enemy tanks on the

LVTH-6

LVTE-1



LVTR-1



(U.S. Marine Corps photos)

ground, the best weapon available is another tank. Tanks do not float, so they must be delivered to a point by landing craft (LCU or LCM), whereby they can proceed ashore with the waves of LVT's already launched. All of these landing craft have the speed and endurance to be launched from amphibious shipping positioned over the horizon,[25] and, if carefully guided and controlled, rendezvous with the LVT force as it launches underway. Admittedly, this procedure is a weakness in the concept, but with some experimentation and effective training, it could be made a viable method of employment.

An imaginative use of the forces as organized under the total FAD concept would open many new options to the modern landing force, while posing a considerable defensive problem for a potential enemy. When confronted with the possible threat of an amphibious assault, the defender of a long, exposed coastline must decide whether he can afford to cover his entire coastline with personnel and fortifications and by doing so lessen his ability to defend his territory in depth, or defend only logical landing sites close by his vital areas, leaving the remainder of his coastline to be defended by mechanized forces located inland. Although he has other options which could be anticipated, basically they would fall somewhere within the two presented.

The amphibious force, on the other hand, has the initiative. It can select the most favorable time and place for its assault. With this in mind, some scenarios can be developed to portray the Fast Amphibian Delivery concept in meaningful terms.

Using figure 3 as an illustration, picture the landing force launching the assault waves of the BAF against a thinly defended stretch of beach. The launch is conducted underway along the LOD which is established at 2,000 yards off shore. The initial waves of the BAF are composed of LVTH's to provide assault fires during the movement

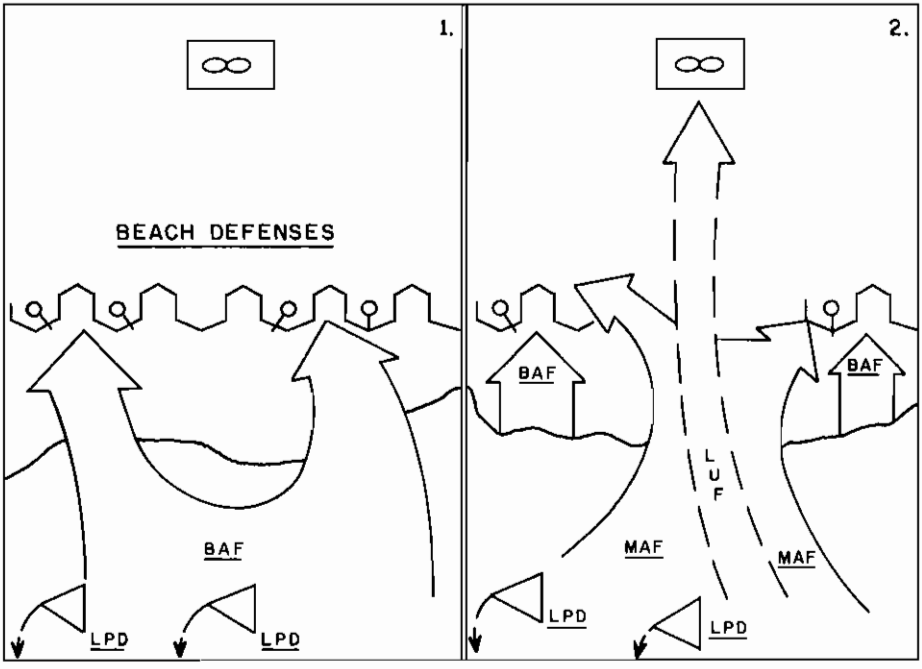


Fig. 3.—The FAD against a Thin Beach Defense Area.

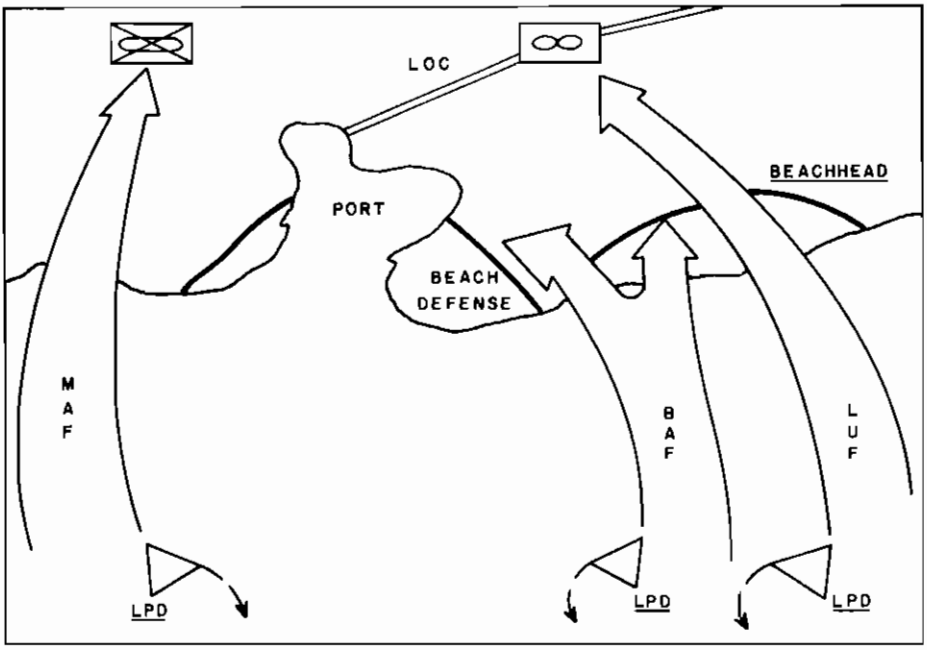


Fig. 4.—The FAD against a Concentrated (Limited Area) Beach Defense Supported by a Mobile Defense Force.

ashore, LVTE's to breach minefields and obstacles, and the personnel carriers with the infantry and their organic weapons to attack and seize the beach defenses. Following close behind these forces would be those of the MAF. Once ashore, the MAF, utilizing its built-in shock power and mobility, could penetrate through the fortifications and exploit this penetration by attacking the exposed enemy flank and rear.

To complete this admittedly oversimplified scenario, the employment of the LUF must be considered. Simultaneously with the beach assault, a force would be landed by helicopter astride the enemy's lines of communication well behind the beach defenses. Once the Mobile Attack Force has opened a gap in the beach defenses, the LUF is called ashore. The same ship-to-shore method as employed by the BAF and the MAF would be used, except that this force could move directly to the beach in column. Without stopping, the LUF could move inland through the penetration and link up with the helicopter-borne elements of the landing force.

Another scenario could describe a situation in which an enemy has set up a concentrated beach defense system around desirable landing sites close to obvious amphibious force objectives. He has established his mechanized units inland in a position to cover unprotected areas of his coastline, as well as to be able to reinforce his beach defense system. It is within this type of situation that the speed, mobility, and flexibility of the FAD concept could be exploited to the fullest.

The key to success against an enemy defense deployed in the manner described is in neutralizing or destroying his mechanized units. To accomplish this end, speed is of the essence. As shown in figure 4, the amphibious force, again using the underway launch technique, lands both the BAF and the MAF simultaneously at separate locations

over undefended beaches which flank the enemy's fortified positions. At the same time, the helicopter-borne force is landed well behind the defender's mechanized elements. The MAF moves rapidly inland to engage the mechanized force and the BAF consolidates its beachhead. If the terrain around the beachhead cannot support the follow-on landing of support units, heavy equipment, and supplies, the BAF could be given the mission to assault the enemy's defenses from the flank. The defender is then faced with elements of the landing force approaching his forces from three separate directions. Once he has committed his mechanized elements to a specific course of action, the LUF can be landed to bolster helicopter-borne units or, depending on the situation, to act as a reserve element for either the BAF or the MAF.

These brief scenarios were intended to illustrate, by example, the application of the Fast Amphibian Delivery concept in its broadest form. Certainly, with modification, it has other uses.

In an insurgency situation, the concept would allow the landing force to rapidly protect vital installations and population centers from guerrilla units, and utilize the mobility of the force to keep these same guerrilla units off balance.

The FAD concept can also have applications in a daytime or nighttime amphibious raid. As the success of a raid depends primarily on surprise and speed of execution, the insertion of a raiding force at any number of points along an enemy's coastline is a logical use for the LVT and the underway launch technique.

Problem Areas. Like any new and untested idea, the Fast Amphibian Delivery concept contains several areas which may pose some difficult problems. The issue of the integration of the tank elements into the Mobile Attack Force has already been discussed, but it will remain the foremost soft spot in the concept.

Command and control over the various forces will present the amphibious task force commander and the landing force commander with a real challenge. Coordination and communication between elements will be essential to success. Any breakdown in either one of them will spell disaster for the operation. As far as the helicopter wave guide concept is concerned, it would be a significant improvement if it could be used under the present doctrine.

The difficulties of logistical support of a rapid-moving, vehicular-mounted landing force require special consideration. Although the LVTPX-12 has a combat range of 300 miles, it will require fuel and spare parts support for sustained operations ashore. The requirement for ammunition, rations, and water will always exist. The FAD concept does allow for the faster development of the beachhead, which would in turn put within the realm of possibility a more rapid buildup of a logistical support base ashore. To speed up the movement of supplies and equipment ashore, however, new concepts may be required.

From Proposal to Doctrine. The initial requirements which were set forth at the outset of this chapter for a proposed change to the LVT employment doctrine can be met. It has been shown that the speed of the ship-to-shore movement can be increased, the vulnerability of the amphibious force can be lessened, and when properly organized, the surface landing force embarked in LVT's can be a mobile and effective factor on the modern amphibious battlefield.

Concepts from which doctrine can be established must meet more than theoretical tests. They must be tested under controlled operational exercises. As there is a real need for new doctrine, let us not wait to recognize this fact amid

the wreckage and debris of a modern-day Betio.

V—CONCLUSIONS AND RECOMMENDATIONS

> The history of warfare shows that the basic strategic asset of sea-based peoples is amphibious flexibility. In tackling land based opponents, they can produce a distraction to the enemy's power of concentration that is advantageously disproportionate to the scale of force they employ and the resources they possess.
>
> But for full advantage this flexibility needs to be coupled with rapidity in exploitation. For the distraction-effect is likely to diminish once the landing takes place. . . .[1]

This statement, written by one of the eminent military scholars of recent times, B.H. Liddell Hart, sounds the keynote for amphibious warfare and its application by the United States in the prosecution of any maritime campaign. By extracting the phrase, "flexibility needs to be coupled with rapidity in exploitation," the role of the tracked amphibian in modern amphibious warfare can be brought sharply into focus.

Flexibility and Rapid Exploitation: the Modern Role. The tracked amphibian is a vehicle with a two-dimensional capability. With the arrival on the scene of the new LVTPX-12, possessing significantly improved performance characteristics in both dimensions, the part it can play in the assault from the sea can be expanded to capitalize on these improvements. This expansion could have the ultimate effect of increasing the ability of an amphibious force to succeed against any potential enemy, regardless of the composition and disposition of his military units. The means to this end is the proposed Fast Amphibian Delivery concept.

The incorporation of this concept as part of the doctrine for amphibious operations would provide the landing force with a flexibility of action and a mobility on the ground that it has not always enjoyed with the present equipment and doctrine. It would expand the role of the LVT to that of a real amphibious armored personnel carrier, capable of rapidly moving troops ashore, forming the nucleus of mobile task forces, and transporting its cargo of men and equipment to the critical areas of the battlefield.

What of the remainder of the amphibious force? While this is beyond the scope of this paper, it can be concluded that in order to implement the proposed concept, a number of changes will be necessary in the overall composition and the employment of other elements of the force. Chapter IV touched on the need to keep the 20-knot amphibious ships on the move so as to reduce their vulnerability to attack. In addition, modifications will have to be made to the phased buildup of logistical support, so that it will be more responsive to a

BIOGRAPHIC SUMMARY

Maj. Robert C. Caldwell, U.S. Marine Corps, has had extensive experience with amphibious operations and amphibian vehicles. He has served in AMTrac battalions in three different Marine divisions, including an assignment as Commanding Officer of the 1st AMTrac Battalion of the 3d Marine Division operating in the Republic of Vietnam. Having been an instructor in amphibious tactics as well as a participant in actual operations, Major Caldwell is in a unique position to evaluate the effectiveness and weaknesses of our present amphibious doctrine. Major Caldwell graduated from the University of California in 1955 with a bachelor's degree in history and from the Naval War College, School of Naval Command and Staff, Class of 1969.

more fluid and fast-moving scheme of maneuver ashore. Undoubtedly, there will be other factors which will have to be considered during the course of making the FAD concept a viable doctrine, but only through test and experimentation will they be isolated.

Recommendations. Under the National Security Act of 1947, the Marine Corps is charged with the responsibility to develop, in coordination with the other services, those aspects of amphibious warfare that deal with tactics, techniques, and equipment used by the landing force. It is within this context that the following recommendations are submitted:

1. That the underway launch technique be adopted as the standard method used by LVT's in the execution of the ship-to-shore movement.

2. That the proposal for the Fast Amphibian Delivery concept be studied in detail and eventually tested in amphibious training exercises, so that if the concept passes the tests for feasibility, suitability, and acceptability it could be ready in some form for the arrival of the new LVT.

3. In conjunction with the Navy, that a study be made of the organization and techniques which may be required for the support by the amphibious force of the FAD concept.

The time will soon be here when the LVTPX-12 will be placed at the disposal of Fleet Marine Force units. It would be a sheer waste of its capabilities to employ this advanced amphibian under doctrine that could be executed by Roebling's Alligator. It is necessary to update the LVT's role in amphibious warfare, because until such time as helicopters or surface effect vehicles can be produced to carry large numbers of troops and the heavier implements of war in the quantities required, the LVT will have to play an important part in the amphibious operations of the future.

FOOTNOTES

I—THE DEVELOPMENT OF AN AMPHIBIAN

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19. Smith, "Development of Amphibious Tactics in the U.S. Navy," p. 44.
20. Nohrden, p. 14.

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5. U.S. Marine Corps, *History of the U.S. Marine Corps Operations in World War II* (Washington: U.S. Marine Corps, G-3 Division, Historical Branch, 1963), v. II, p. 294.
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12. Julian C. Smith, "Tarawa," *United States Naval Institute Proceedings*, November 1953, p. 1172-1173.
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17. Croizat, p. 45.
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22. Isely and Crowl, p. 210.
23. U.S. Marine Corps, v. III, p. 152.
24. Croizat, p. 46.
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30. Konrad F. Schreier, Jr., "Whaleboats to AMTrac," *Marine Corps Gazette*, February 1969, p. 36.
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33. The LVTP-5 is complemented by what is called a "family" of vehicles with functions other than troop and cargo carrying. The rest of the family includes: An LVT(C) for communications, an LVTH or armored AMTrac for fire support, an LVTE for mine and obstacle clearance, and an LVTR for maintenance and recovery.
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2. *Ibid.*, p. 109.
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4. The Institute for Strategic Studies, *The Military Balance 1967-1968* (London: 1967), p. 7-8.
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6. *Ibid.*, p. 19.
7. *Ibid.*, p. 19.
8. Rathvon McC. Tompkins, "Urgent, Land the Tanks," *Marine Corps Gazette,* March 1951, p. 18.
9. William P. Haight, "Amphibious Warfare, Today and Tomorrow," *Interavia,* May 1966, p. 574.
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12. Robert D. Heinl, Jr., "The Marine Corps—Here to Stay," *United States Naval Institute Proceedings,* October 1950, p. 1086.
13. Haight, p. 576.
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IV—FAST AMPHIBIAN DELIVERY: A DOCTRINE IS PROPOSED

1. U.S. Marine Corps, *FMFM 9-2,* p. 1.
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3. Of the three ships mentioned, only the 1179 Class LST is not yet with the fleet. James B. Soper, "The Amphibious Assault Forces," *Naval Review 1966* (Annapolis: U.S. Naval Institute, 1966), p. 32.
4. David G. Henderson, "Proposal," *Marine Corps Gazette,* June 1967, p. 42.
5. LPD can embark up to 37 LVT's, plus six CH 46 transport helicopters, LSD can embark 49 LVT's. (Capacity of the new LST is not available. *Ibid.,* p. 42; U.S. Marine Corps, *Embarkation,* FMFM-11 (Washington: 1962), p. 160, 162-163.
6. Schreier, p. 36.
7. LVTP-5 can carry up to a ¾-ton truck or a 105 mm. howitzer.
8. Joseph H. Alexander, "LVTPX-12 Test Program: a Progress Report," *Marine Corps Gazette,* February 1969, p. 39; U.S. Marine Corps, *FMFM 9-2* p. 182-183; Fleet Marine Force Pacific, *Tactical Trends and Training Tips,* 14 March 1966, p. 17-18.
9. Alexander, p. 40.
10. Similar to the LVTP-5, the new family of vehicles will include: an LVTC, command and communications vehicle; an LVTH armed with a 105 mm. howitzer in a turret; and LVTE, mine clearance vehicle; and LVTR, recovery vehicle.
11. Alexander, p. 37.
12. FMC Corporation, Ordnance Division, *LVTPX-12, Assault Amphibian Personnel Carrier* (n.p.: 1968), p. 2-4.
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16. David S. Bill, "The Amphibious Assault," *United States Naval Institute Proceedings,* October 1962, p. 49.
17. Michael J. Hanley, "A 60 Knot Landing Force," *United States Naval Institute Proceedings,* March 1967, p. 48.
18. Henderson, p. 42-43.
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20. U.S. Marine Corps, *FMFM 9-2,* p. 18.
21. The times indicated here are based on the capabilities of the LVTPX-12. The LVTP-5 would take 25.2 minutes under the present doctrine and 10.7 minutes if launched underway.

22. For training purposes, the LVTP-5 can operate at sea when the surface wind waves do not exceed 6 feet and the swells are no greater than 10 feet. The LVT can safely negotiate a surf of up to 10 feet in height. U.S. Marine Corps, *Safety Procedures for LVTP-5 Family of Vehicles*, TI 2320-15/2 (Washington: 1961), p. 2-3.
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25. U.S. Marine Corps, *FMFM 9-2*, p. 173-180.

V—CONCLUSIONS AND RECOMMENDATIONS

1. Basil H. Liddell Hart, "Foreword," to Heinl, *Soldiers of the Sea*, p. vii.

Ψ

Amphibious flexibility is the greatest strategic asset that a sea power possesses.

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